Claims

What is claimed is:

1. A plasma processing system comprising:

a plasma processing device having a first plasma density proximate a processing region and a second plasma density proximate an exit region;

an inter-stage plasma (ISP) source fluidly coupled to said plasma processing device proximate said exit region, said ISP source comprising an inter-stage plasma region having a third plasma density; and

a plasma pump fluidly coupled to said ISP, said plasma pump having a fourth plasma density, wherein pumping speed is dependent upon the third plasma density and the fourth plasma density.

2. The plasma processing system as claimed in claim 1, wherein said first plasma density is greater than said second plasma density.

3. The plasma processing system as claimed in claim 1, wherein said third plasma density is greater than said second plasma density.

4. The plasma processing system as claimed in claim 1, wherein said third plasma density is greater than said fourth plasma density.

5. The plasma processing system as claimed in claim 1, wherein said ISP comprises an inductively coupled plasma (ICP) source.

6. The plasma processing system as claimed in claim 1, wherein said ISP comprises a capacitively coupled plasma (CCP) source.

7. The plasma processing system as claimed in claim 1, wherein said ISP comprises a ring-shaped channel.

8. The plasma processing system as claimed in claim 1, wherein said ISP comprises a plurality of cylindrical channels arranged in a ring pattern.

9. The plasma processing system as claimed in claim 8, wherein said plasma pump comprises:

an annular conduit having an inlet end coupled to said ring-shaped channel, an outlet end, an interior wall, and an outer wall extending from the inlet end to the outlet end; and

magnet array, constructed and arranged to generate a magnetic field having field lines generally parallel to the outer wall.

10. The plasma processing system as claimed in claim 9, wherein said plasma pump comprises an electric field generator, constructed and arranged to generate a DC electric field having field lines generally parallel to the outer wall.

11. A method of operating a plasma processing system comprising:

creating a plasma in a plasma processing device, said plasma having a first plasma density proximate a processing region and a second plasma density proximate an exit region;

moving a first number of particles from said exit region into an inter-stage plasma (ISP) source that is fluidly coupled to said plasma processing device proximate said exit region;

creating an inter-stage plasma having a third plasma density, said ISP source providing RF energy to said first number of particles in an inter-stage plasma region; and

pumping a second number of particles from said inter-stage plasma region to an exit region, wherein a plasma pump is fluidly coupled to said ISP, said plasma pump having a fourth plasma density, wherein pumping

speed is dependent upon the third plasma density and the fourth plasma density.